

Remarks

Favorable reconsideration of this application is requested in view of the above amendments and in light of the following remarks and discussion.

Claims 1-18 are pending in the application. Claims 1, 2 and 6 are amended, and new claims 11-18 are added. Support for the changes to the claims is self-evident from the originally filed disclosure, including the original claims, and therefore no new matter is added.¹

In the Office Action claims 1-4, 6, 8 and 9 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Japanese Publication No. 2000-349070 to Okawa et al. (Okawa) in view of U.S. Patent No. 6,264,852 to Herchen et al. (Herchen) and PCT Publication No. WO00/13219 to Saito et al. (Saito).² Claim 5 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Okawa in view of Herchen, and further in view of Japanese Publication No. 08-107102 to Ueda et al. (Ueda). Claims 7 and 10 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Okawa in view of Herchen, and further in view of U.S. Patent No. 6,074,516 to Howald et al. It is requested that the rejections of the claims be withdrawn, and the claims allowed, for the following reasons.

The present invention, as recited in the claims, can make it possible to easily replace an upper electrode cover window member when fogged up, and to therefore reduce the cost of maintenance of the plasma treatment apparatus.

¹ Support for the changes to claims 1, 2, and 6 is provided by Figures 2 and 4, and the accompanying description. Support for new claim 11 is provided by Figure 3 and the accompanying description. New claims 12-14 are supported by page 12, lines 19-30 of the specification, as well as Figures 2 and 4 and the accompanying descriptions. New claim 15 is supported by page 16, lines 10-12 of the specification, as well as Figures 2 and 4 and the accompanying descriptions. New claim 16 is supported by page 14, lines 7-11 of the specification, as well as Figure 3 and the accompanying description. New claims 17 and 18 are supported by Figures 2 and 4 and the accompanying descriptions.

² U.S. Patent No. 6,562,186 to Saito et al. is identified in the Office Action as corresponding to the PCT Publication to Saito.

To provide the above advantages, the present invention as recited in independent claims 1, 2, and 6 includes a vacuum vessel that houses an article to be plasma-treated in a plasma region. An upper electrode main body forms the plasma region in the vacuum vessel, the upper electrode main body having formed therein an opening. An upper electrode cover is joined to a lower surface of the upper electrode main body and faces the plasma region. The upper electrode cover has formed therein a hole at a location corresponding to the opening of the upper electrode main body. A window member is made of a transparent member which is a separate body from the upper electrode cover, has a shape insertable into the hole of the upper electrode cover, and is retainably and upwardly removably fitted in the hole of the upper electrode cover.

In contrast, it is submitted that the above-discussed references do not disclose or render obvious the claimed features of a window member made of a transparent member which is a separate body from an upper electrode cover, having a shape insertable into a hole of the upper electrode cover, and retainably and upwardly removably fitted in the hole of the upper electrode cover.

Okawa relates to a plasma processing unit, and discloses that a window member 4 for the plasma processing unit has a main body 4A removably fitted in a hole 2E of an electrode body 2A of an upper electrode 2, and a quartz glass member 4C as a transparent member fitted in a recess portion 4B formed at an upper surface of the main body 4A. See column 5, lines 16-22, and Figures 3 and 4.

Although Okawa discloses the main body 4A itself of the window member 4 being removable, it is difficult to replace the glass member 4C in the main body 4A. In order to remove the glass member 4C for replacement, it is required to remove a holding member 4D that fixes the quartz glass member 4C in a recess portion 4B, or to remove the whole window member 4. See column 5, lines 20-22 as well as Figure 3. Therefore, the glass member 4C

cannot be removed due to the presence of the holding member 4D that holds the glass member 4c.

Further, Okawa neither depicts nor describes providing another glass member, other than the glass member 4C, that is retainably and upwardly removably provided in an electrode plate 2B.

Herchen discloses, in column 7, lines 54-58 and Figures 2, 3a and 5, that a transparent window 170 provided in a process chamber 15 for processing semiconductor substrates is for use in an optical endpoint detection system 175. The transparent window can have a circular, oval or polygonal shape, and can have a transparent insert (or transparent portion) bonded with an inner surface of an opening formed in a gas distributor 35, as discussed in column 8, lines 46-47 and lines 50-52.

Although Herchen discloses the transparent window 170 having a variety of shapes and including a transparent insert bonded with an inner surface of an opening formed in the gas distributor 35, the transparent window 170 is formed into a shape suited to be bonded with an inner surface of the opening. Consequently, the transparent window 170 of Herchen having once been bonded with the inner surface of the opening can not be removed therefrom at the time of maintenance or replacement. Therefore, the transparent window 170 cannot be arranged so as to be easily replaced.

Saito relates to a plasma processing apparatus for a semiconductor processing system, and specifically to an improvement of a window device used for leading plasma light emitted from plasma out of a process chamber. *See* column 1, lines 4-8. As disclosed in column 5, lines 22-27 and as shown in Figure 1, an etching apparatus 100 includes a process chamber 1 of which a sidewall 1b provides a window device 12 used for leading out plasma light emitted from the plasma generated in the process chamber 1, so that the state of the plasma is detected.

The window device 12 includes a window plate or first member 21, a light guide or second member 22, and a cover plate or third members 23. The first member 21 is made of quartz and is inlaid in the sidewall 1b of the process chamber 1. The second member 22 is made of aluminum with an anodized (anode-oxidation-processed) surface and is inlaid in the wall of a shield member 11 at a position corresponding to the first member 21. The third member 23 is made of single-crystalline sapphire and is in contact with and fixed onto the surface of the second member 22 on the first member 21 side. *See* column, lines 55-65, and Figure 2. The third member 23 is in contact with and fixed to the surface of the second member 22, such as adhesive tapes or screws, so that it is integrated with the second member 22. *See* column 6, lines 35-39. Only the third member 23 (or the second and third members 22 and 23) needs to be replaced with a new member when the light transmittance is lowered. *See* from column 7, line 65 to column 8, line 10.

In a window device 42 shown in Figure 6 of Saito, according to another embodiment, a first member 21 is pressed against the sidewall 1b by a pushing frame 43, and the pushing frame 43 and a flange 22b of the second member 22 are fixed to the sidewall 1b by screws 44. *See* column 8, lines 19-22.

Thus, although Saito discloses replacing only the third member 23 which is a part of the window devices 12 and 42, each of these window devices is fixed to the sidewall 1b by using the pushing frame and screws. The arrangement of the pushing frame and the screws is arranged as shown in Figure 2 or Figure 6, in order to make it possible to replace the window device on the sidewall 1b.

Therefore Saito merely suggests laterally removing the window device partly or in its entirety from the sidewall 1b, i.e., laterally removing the window device, and fails to disclose or suggest making the window device removal from above for easy replacement.

Ueda discloses a plasma etching device comprising a cover 14 made of quartz which covers an upper electrode 12. *See* the abstract.

However, Ueda does not teach or suggest providing a removable window member in the cover 14. It is submitted that even if a window member is provided in the cover 14, Ueda still does not depict or describe removing a window separately from the cover 14.

Howald relates to a plasma processing system 100, and discloses in column 6, lines 17-19 and lines 24-25, as well as in Figure 4, a dielectric window 110 (300) disposed within a plasma processing chamber 102 and having a plug portion 302 which forms an observation window. Howald further discloses, in column 6, lines 56-59 and Figure 4, that in order to prevent a vacuum leak around the plug portion 302, a seal 402 is disposed between a flange of the plug portion 302 and a shoulder formed in the remaining portion of the dielectric window 300. Alternatively, an appropriate adhesive is employed with the plug portion 302 disposed in a through hole or a countersunk hole. *See* column 6, lines 59-64.

Thus, although Howald discloses the plug portion 302 of which a lower portion has a reduced diameter (Figure 4), the plug portion 302 serves as an observation window and therefore requires an appropriate seal arrangement, such as adhesive, to prevent a vacuum leak around the plug portion 302. Restated, Howald teaches the plug portion 302 that is to be affixed using an appropriate seal arrangement in order to prevent a vacuum leak. Consequently, the plug portion 302 of Howald can not be made removable at the time of maintenance. Therefore, the plug portion 302 cannot be arranged so as to be removed for easy replacement.

According to the present invention, the window member has a novel and unobvious design in that the window member is provided in an upper electrode cover, which is separate from an upper electrode main body or the sidewall of a vacuum vessel, and that the window member is retainably and upwardly removably fitted in a hole of the upper electrode cover

simply by being inserted into the hole. As a result, it is possible to retain the window member in place in use without using fasteners for the window member such as the above discussed pushing frame, screws, tapes, or adhesives required by the prior art references, and to make it easy to replace the window member from above at the time of maintenance, contrary to the disclosure of the references.

For these reasons, it is submitted that independent claims 1, 2 and 6, from which the remaining claims depend, are allowable over the references of record in the application. The allowance of claims 1-18 is therefore requested.

Notwithstanding the above discussion, which provides sufficient grounds for the allowance of claims 1-18, the following comments regarding further features that are not disclosed or rendered obvious by the references of record, are submitted for the Examiner's consideration.

As recited in new dependent claim 15, a window member is in contact with a lower surface of a tubular member. By this arrangement, the tubular member can naturally urge the window member toward an upper electrode cover by gravity acting on the tubular member. As a result, it is not necessary to use of a seal arrangement, such as a seal 402 and adhesives as disclosed in Howald, or a pushing frame and screws as disclosed in Saito.

As recited in new dependent claim 16, a tape is stuck to fix an upper electrode cover to a window member. The claimed arrangement of the tape differs from the seal 402 of Howald and from the adhesive tapes of Saito. As a result, the tape of present invention can be easily unstuck simply from above for maintenance or replacement of the window member.

It is submitted that the forgoing provides alternate grounds for the allowance of these claims.

Consequently, for the reasons discussed in detail above, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. Therefore, a Notice of Allowance is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact the undersigned representative at the below listed telephone number.

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